Why is my baled silage crappy?

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Too many silage bales are incorrectly wrapped resulting in substantial losses of dry matter (DM) and quality. There are no short cuts when wrapping round or square baled silage. There are no cost savings by scrimping here and there on plastic such as by not applying the last one to two turns of plastic or stretching the film more than the film or machine is designed to do by swapping cogs.

Forage ensiled in bales at the correct DM content, densely compacted and wrapped with the correct number of layers of stretchwrap over the entire bale, should have a pleasant smell with negligible mould anywhere when opened up to twelve months later. The amount of mould and its location can indicate how well, or not, the bale has been wrapped, or occasionally, how good the film is, or not.

Baled silage has 6 to 8 times the surface area in contact with the plastic film compared to conventional stack silage and about half of the silage volume is within 15 cm of the plastic film. Therefore it is important that the integrity of the film is not compromised in any way. This article discusses some of the reasons for failures in baled silage.

Incorrect dry matter content
Forage ensiled too wet will undergo a poor fermentation resulting in DM and nutritive losses in the silage bales. They will have an unpleasant odour and be unpalatable for stock. The bales will probably have slumped and be very heavy and difficult to handle. The wetter, the worse the problems. Appropriate silage additives can help to encourage a better fermentation despite the excess of moisture, as long as they are applied at the correct rate, based on the fresh weight of forage.

Conversely, silage made too dry will highly likely become mouldy and contain yeast when opened or the plastic is holed. Individually wrapped bales will greatly reduce the problem of over-dry silage but not if stored in modules under sheets of plastic.

Some farmers appear to be having success of baling slightly damper silage than recommended but this is due to very dense compaction, vegetative pastures high in sugars and individually or continuous in-line wrapped.

Table 1 illustrates the recommended DM targets for each type of silage and forms of storage.

Plastics ain't plastics! Films can vary in permeability to air, consistency in its stretching capacity, degree and longevity of adhesiveness or "tackiness", contain irregularities from the production line, have unevenness of colour integration. Most importantly, the quality and amount of ultra-violet (UV) light inhibitor impregnated into the plastic film can vary substantially between products and sometimes, even within a run within a manufacturer.

Some overseas films are produced for the markets such as the Scandinavian countries which has low levels of light intensity, even in their warmest months and so, contain very little UV inhibitor. At the end of their harvest season, the Australian season soon follows and it is convenient to offload the excess overseas film onto our market, often cheaper since the Australian product requires a high concentration of UV inhibitor.

Table 1: Target DM contents for various crop, harvesting methods and storage types

Crop type (Stage to cut)	Pit/stack (DM %)	Round Bale (DM %)[2]
Pastures (Vegetative - very early heading)		
Long chopped	30 - 35	40 – 50
Precision chopped	30 - 40	
Lucerne (Bud - <10% flowering)		
Long chopped	33 - 35	40 –50
Precision chopped	33 - 38	
Other pasture legumes (early – mid-flowering)		
Long chopped	33 - 35	40 –50
Precision chopped	35 - 40	
Whole-crop cereals (Vegetative – Must be wilted) (Oats[1], ryecorn[1], barley, wheat, triticale)		
Flag leaf – Boot stage	33 - 40	38 – 50
Whole-crop cereals (Direct harvest standing crop) (Barley, wheat, triticale)		
Late milk - Soft dough stage	36 - 42	38 – 45
Whole-crop cereals as **Alkalage** (Direct harvest + "Home'n'Dry®") (Barley wheat, triticale)		
Early – late hard dough stage	65 - 85	
Maize		
Precision chopped	33 - 36	
Summer Forages (Sweet sorghums, millets)		
Long chopped	30 - 35	35 – 45
Precision chopped	30 - 40	
Brassicas/Chicory[3]	33 - 38	35 – 45

[1] Oats and rye corn not recommended to be baled at the soft dough stage as quality is low, exclusion of air is difficult often causing poorer fermentation, resulting in a severe decrease in quality and increased mould growth.
[2] Large rectangular-baled silage could be 5 – 10% DM higher at the high end of each range but, if too dry, fermentation will be very restricted and losses due to yeasts, moulds and aerobic bacteria activity, leading to spoilage will be very substantial if plastic is holed! Individually or continuous inline stretch wrap these only.
[3] Thick stemmed brassica and chicory need to be mown with a roller mower-conditioner to squash the stems to even drying somewhat with the leaves.

Although much less frequent now, the result has been a very quick break down of those imported plastic films in our high solar radiation climate. However, most of our own products and several overseas products are very well manufactured and serve us well. Now many films are being produced in Asian countries and some of the same issues have arisen in recent times.

Stretch rate: Many people think that all plastics will prevent all air from passing through the film and entering the bale. Wrong! Most stretch warp films have a thickness 25 micron (µm) before application to the bale. If stretched at 55 % and four layers are applied as is most common in Australia, the final thickness will be about 18 – 20 µm. If stretched to 70 %, as is common in New Zealand, thickness is further reduced, hence their recommendation to apply six layers versus our four!

Most earlier wrapping machines built in Australia were designed to stretch the stretch-wrap plastic 55 % as it was laid onto the bale. Now many wrappers pre-stretch silage wrap to 70% but this will be excessive for when a film stipulates a 55% stretch and more so when only four layers are applied. This thinner total thickness of film will allow a substantial entry of air

(actually oxygen) into the bales resulting in mould and yeast growth. Carting rolls around in the ute and/or wrapping in high ambient temperatures (over about 25^{O}C) may drastically affect the properties of some plastics, particularly the stretch rate.

To check that the correct pre-stretch is occurring, mark a small distance on the unwrapped roll on the pre-stretcher, e.g. 10 cm or pocket knife. Once applied to the bale, the mark should now measure about 15.5 cm or just over 1.5 pocket knife lengths.

Some Australian manufactured films are pre-stretched at the factory before being stretched again at a much reduced rate when applied to bale on the farm. This usually require a separate set of gears to achieve the correct stretch ratio. The film arrives on the farm in a ranges of pre-determined thicknesses (12, 14 to 16 µm) and different recommended stretch ratios. This technology was developed to reduce the cost of the film/bale.

Bale Coverage: Every round or rectangular bale that is being individually wrapped MUST have at least 4 layers of plastic over the ENTIRE bale. This is very difficult to achieve with slightly odd shaped bales and the large rectangular bales resulting in underlapping (Figure 1) and only three layers will be applied at that section. This means that plastic coverage is reduced 25% on a seal where 100 % coverage is a must. Overlap for each layer should be at least 50%, no less. Mature or stemmy crops should have 6 layers applied to reduce puncturing of the film.

Figure 1. Plastic underlapped + holed

Number of layers: Bales which have had four layers of stretch wrap film applied at 55 % stretch with a 50% overlap are guaranteed to last 12 months before the film starts to degrade from solar radiation but often lasts several months longer. Practical experience in the field has shown that applying 6 layers at the above stretch will generally ensure bales will last another 12 months. Assuming a bale weighs about 250 kg DM, the extra cost is about $3 – 5 per bale, i.e. $12 – 15 tonne DM or 1.2 – 1.3 ¢/kg DM.

Overseas research comparing 2, 4, 6 and 8 layers, at 70% stretch, has shown that 2 layers will result in huge losses of DM and nutritive value due to mould and yeast growth and aerobic deterioration due to air entering the bale via the insufficient number of layers. Both 6 and 8 layers are superior to 4 layers although greater than 6 layers does not result in economical gains when baling grass silage for dairy cattle. However, 6 to 8 layers may be necessary if wrapping drier or more mature pastures, especially for sheep and horses which have low tolerance to mouldy feeds. Six layers are recommended if bales are to be transported after wrapping.

Plastic Colour: Lighter colours have been shown to be more suited to the hotter areas of Australia compared to black due to less surface heating. Black is more absorbent of solar radiation. However, in the more cool temperate areas such as southern Victoria and Tasmania, black wrap is equally effective and usually less prone to UV break down. Research overseas in similar climate (Ireland, Europe) have shown slight temperature increase into the bale a bit but less than one per cent loss of DM in light, dark and black films.

Centre the bale: The centre of the bale must be in line with the centre of the film reel. Larger diameter bales (4'6", 1.35 cm) are becoming more common and if the reel is not lifted, wrapping will be uneven on the bale.

Holes: The drier the bale, stemmier the material, warmer the temperature, larger the hole and the longer it's left before being repaired, the greater are the DM and quality losses and greater the mould and yeast growth. Apply similar coloured specific silage repair tape to clean, dry and cool/warm plastic.